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IS 1012 (2002): Turbine Lubricating Oils - [PCD 3: Petroleum, Lubricants and their Related Products]



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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
टरबाइन के लिए स्नेहन तेल. — विशिष्टि
(तीसरा पुनरीक्षण)

Indian Standard

**TURBINE LUBRICATING OILS —
SPECIFICATION**
(*Third Revision*)

ICS 75.100

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Lubricants and Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was originally published in 1958, amended in 1966 and revised in 1978. In the first revision, the requirements for viscosity range, flash point, pour point, oxidation test and foaming characteristics were modified. Particular emphasis was laid on the method for determining the oxidation stability and the duration of the test based on the internationally prevailing practices. Further, an additional requirement for air release value was included keeping in view the recommendations of major equipment builders and the users of this product.

The second revision was published in 1987 and in second revision requirements for viscosity index, flash point, air release value and foaming characteristics had been modified based on the field experience and ISO viscosity classification (IS 9466 : 1980 Viscosity classification for industrial liquid lubricants) was adopted.

To meet rapidly growing power demands, a large number of turbines, with or without gear boxes, of varying capacities are expected to be installed in the near future. The power stations based on gas turbines and combined cycle are expected to become popular owing to their inherent efficiency. In view of these developments and to take care of requirements of the equipment builders with regard to load bearing characteristics and cleanliness of turbine oils, it was proposed to revise the specification.

As existing specification deals with only Turbine oil, R&O type (Rust & Oxidation inhibited), in this version (*third revision*) additional performance category, that is Turbine oil, EP type has been included to take care of the load bearing characteristics. Moreover both the above types have been sub-divided into 'Normal' and 'Superclean' categories depending upon the degree of cleanliness.

The composition of the Committee responsible for formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numericals value (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

**AMENDMENT NO. 1 MARCH 2010
TO
IS 1012 : 2002 TURBINE LUBRICATING OILS —
SPECIFICATION**

(Third Revision)

[Page 3, Table 2, Sl No. (i), col 2] — Substitute the following for the existing:

‘Load carrying capacity, failure load stage, *Min*’

(PCD 3)

Reprography Unit, BIS, New Delhi, India

Indian Standard

TURBINE LUBRICATING OILS — SPECIFICATION

(Third Revision)

1 SCOPE

This standard prescribes the requirements and methods of sampling and testing for lubricating oils intended for use as lubricants and control fluids in steam, gas and hydroturbine systems at ambient temperatures of 0 °C and above.

2 REFERENCES

The following Indian Standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
1447 (Part 1): 2000	Petroleum and its products — Methods of sampling: Part 1 Manual sampling (<i>first revision</i>)
1448:	Methods of test for petroleum and its products:
[P: 1]: 1971	Neutralization number of potentiometric titration (<i>first revision</i>)
[P: 2]: 1967	Acidity (<i>first revision</i>)
[P: 10]: 1970	Cloud point and pour point (<i>first revision</i>)
[P: 15]: 1976	Detection of copper corrosion from petroleum products by the copper strip tarnish test (<i>second revision</i>)
[P: 16]: 1990	Density of crude petroleum and liquid petroleum products by hydrometer method (<i>third revision</i>)
[P: 25]: 1976	Determination of kinematic and dynamic viscosity (<i>first revision</i>)
[P: 56]: 1980	Viscosity index by calculation (<i>second revision</i>)
[P: 69]: 1969	Flash and fire point by cleveland (open) cup
[P: 91]: 1979	Emulsion characteristics of petroleum oil and synthetic fluids
[P: 96]: 1980	Rust preventing characteristics of steam turbine oil in the presence of water

<i>IS No.</i>	<i>Title</i>
[P: 102]: 1981	Determination of air release value
[P: 106]: 1981	Determination of oxidation characteristics of inhibited steam-turbine oils
IS 9466: 1980	Viscosity classification for industrial liquid lubricants

3 GRADES AND PERFORMANCE TYPES

3.1 Grades

The lubricating oil shall fall in one of the following four grades as defined in IS 9466 :

- a) VG32,
- b) VG46,
- c) VG 68, and
- d) VG 100.

3.1.1 Lubricating oils of other intermediate viscosities may also be blended as agreed to between the purchaser and the supplier.

3.2 Performance Types

The lubricants shall be of the following two performance types:

- a) *Turbine Oil, Rust and Oxidation (R&O) Type* — It is intended to be used in turbine lubricating system where the machinery does not require lubricants with enhanced load carrying capacity.
 - b) *Turbine Oil, EP Type* — It is intended to be used in turbine lubricating systems where the machinery requires lubricants with enhanced load carrying capacity.
- Each of these two types is further sub-divided into two categories, namely 'Normal' and 'Superclean' depending upon the cleanliness level.

4 REQUIREMENTS

4.1 Description

The oil shall be blended from suitably refined turbine quality base stocks and additives such as rust and oxidation inhibitors and selected additives as required to control wear, foam, demulsibility, etc, to meet the requirements of this standard. The use of viscosity improvers is not permitted.

4.1.1 The finished oil shall be clear and free from water, suspended matter, dirt, sediment and other extraneous impurities.

4.2 Homogeneity

The additives used shall be wholly soluble in the oil and shall be uniformly distributed throughout at all temperatures above the specified pour point upto 120 °C. When cooled to 6 °C below its pour point for 4 h, the oil shall regain homogeneity and shall show no evidence of separation or stratification when brought to the ambient temperature in an undisturbed condition.

4.3 The properties of the oil shall not be affected by water washing determined by testing the rust preventive characteristics [see SI No. (viii) of Table 1] after the procedure described in Annex A.

4.4 Compatibility

Oils supplied against this standard shall be compatible with any other oil fully meeting the requirements of this standard. Oils shall be considered to be compatible, if a mixture of equal volumes of unused oils complies fully with the requirements of this standard.

4.5 Specific Requirements

The 'Normal' category of both R&O and EP type of oils shall comply with the requirements given in Table 1, when tested according to the methods prescribed in col 7 of Table 1.

The 'Superclean' category of R&O and EP type oils should also meet additional cleanliness test requirement as specified in the footnote of Table 1.

The EP type of oil should also meet additional requirement of load bearing characteristics as specified in Table 2.

4.6 Optional Requirements

The material shall also meet the requirements of the hydrogen solubility test. The test values and the method shall be as agreed to between the purchaser and the supplier.

5 PACKING AND MARKING

5.1 Packing

The material shall be packed in metal containers or in other suitable containers as agreed to between the purchaser and the supplier.

5.2 Marking

Each containers shall be securely closed and marked with the following information:

- a) Name and grade of the material;
- b) Indication of source of manufacturer;
- c) Net mass in the container;
- d) Batch number or code number;
- e) Date of manufacture; and
- f) Recognised trade-mark, if any with identification in code of otherwise to enable the lot of consignment or manufacturer to be traced back.

5.2.1 BIS Certification Marking

The containers may also be marked with the Standard Mark.

5.2.1.1 The use of Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufactures or producers may be obtained from the Bureau of Indian Standards.

6 SAMPLING

6.1 Representative sample of the material shall be drawn as prescribed in IS 1447 (Part 3).

6.2 Number of Tests

Tests for kinematic viscosity and viscosity index shall be conducted on each of the individual samples while the remaining tests shall be made on the composite sample.

6.3 Criteria for Conformity

6.3.1 The lot shall be declared as conforming to the requirements for kinematic viscosity if the expression $\bar{X} + 0.6 R$ lies within the range specified in Table 1.

6.3.2 The lot shall be declared as conforming to the requirements for viscosity index if the expression $\bar{X} - 0.6 R$ is greater than or equal to the minimum limit specified in Table 1.

6.3.3 In respect of each characteristic tested on the composite sample, the lot shall be declared to meet the specification requirements if all test results on the composite sample meet the corresponding requirement given in the specification.

NOTE — In a single consignment, all containing material of the same grade and belonging to the same batch of manufacture shall be grouped together to constitute a lot.

Table 1 Requirements for Turbine Lubricating Oils of R&O and EP Type
 ('Normal' and 'Superclean'¹⁾)
 (Clauses 4.3 and 4.5)

Sl No.	Characteristics	Requirement for Grades				Method of Test, Ref to [P:] of IS 1448
		VG 32	VG 46	VG 68	VG 100	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Kinematic viscosity at 40°C, mm ² /s					[P : 25]
	Min	28.8	41.4	61.2	90	
	Max	35.2	50.6	74.8	110	
ii)	Viscosity index, Min	100	98	95	95	[P : 56]
iii)	Total acid numbers (TAN) mg KOH/g, Max	0.3	0.3	0.3	0.3	[P : 1]
iv)	Inorganic acidity, mg KOH/g	Nil	Nil	Nil	Nil	[P : 2]
v)	Flash point, Cleveland open cup, °C, Min	190	200	210	210	[P : 69]
vi)	Pour point, °C, Max	- 6	- 6	- 6	- 6	[P : 10]
vii)	Corrosiveness to copper at 100°C for 3 h, Max	← Not worse than No. 1 →				[P : 15]
viii)	Rust preventing characteristics 24 h test	← Shall pass the test →				(P : 96 Procedure B) (see also Annex A)
ix)	Emulsion characteristics, Max	← 40-40-0 → (20)		← 40-40-0 → (25)		[P : 91]
x)	Foaming characteristics, Max					[P : 67]
	a) Seq. I 24°C, ml	← 300/nil →				
	b) Seq. II 93.5°C, ml	← 25/nil →				
	c) Seq. III 24°C, ml	← 300/nil →				
xi)	Oxidation stability ²⁾ time to reach 2.0 TAN, Min, in h	2 500	2 000	2 000	1 500	[P : 106]
xii)	Air release value at 50°C Max, minutes	5	6	8	10	[P : 102]
xiii)	Cleanliness, gravimetric (0.8µ filter porosity), mg/100 ml, Max	3.0	3.0	3.0	5.0	[P : 3 ³⁾]
xiv)	Density at 15°C, g/ml, Max	0.900 0	0.900 0	To report	To report	[P : 16]

¹⁾ The 'superclean' category of both R&O and EP type oils should also meet additional 'cleanliness' test requirement of class 8 Max as per NAS 1638. These limits apply only at the time of delivery. The cleanliness limits are meant to be only representative of good workmanship in manufacture and as general practice the oil must be filtered prior to its charging in the lubrication system according to equipment manufacturer's recommendations.

²⁾ This is a type test for which manufacturers/suppliers shall give the guarantee for its compliance.

³⁾ Under preparation. Till such time the Indian Standard is published, the method ASTM D 4898 shall be used.

Table 2 Additional Requirement for Turbine Lubricating Oils of EP Type
 ('Normal' and 'Superclean')
 (Clause 4.5)

Sl No.	Characteristics	Requirement for Grades				Method of Test, Ref to [P:] of IS 1448 ¹⁾
		VG 32	VG 46	VG 68	VG 100	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Load carrying capacity	← 8th stage for all viscosity →				[P : 1 ¹⁾]

¹⁾ Under preparation. Till such time the Indian Standard is published, the method CEC L-07-A-71 published by Co-ordinating European Council, UK or DIN 51354 may be followed.

ANNEX A

[Clause 4.3 and Table 1, Sl No. (viii)]

METHODS FOR DETERMINATION OF RUST PREVENTIVE
CHARACTERISTICS AFTER WATER WASH

A-1 PROCEDURE

A-1.1 The methods described in Procedure B of IS 1448 [P : 96] shall be used with the following modifications:

- a) Stir 300 g of oil with 50 g of distilled water for 30 min at $90 \pm 1^\circ \text{C}$ using the beaker and stirrer specified in the method.
- b) At the end of the mixing period, transfer the mixture of oil and water to a separating funnel and leave it to separate.
- c) Draw-off the separated water layer and test the washed oil by Procedure B of IS 1448 [P : 96] for its rust preventive characteristics.

ANNEX B

(Foreword)

COMMITTEE COMPOSITION

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